High Resolution Study of Mesonic 0- State in ^{16}O

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Isovector $J^{\pi} = 0^-$, $0^{\pm} \rightarrow 0^{\mp}$ excitations axe of particular interest since they carry the simplest pion-like quantum number. Orihara et al. reported the angular distribution for the ^{16}O(p, n)^{16}N(0^-, 0.12 MeV) reaction at T_p = 35 MeV. The discrepancy between the DWBA calculation and their data in the large momentum transfer region of q = 1.4-2.0 fm^{-1} has been observed, which might be due to the effect of the enhancement of the pion probability in the nucleus. However, in the proton inelastic scattering to the 0^-, T = I state in ^{16}O at T_p = 65 MeV, such an enhancement was not observed. The differences between (p, n) and (p, p') results might indicate the contribution from complicated reaction mechanisms in these low incident energies. At intermediate energies of T_p > 100 MeV, reaction mechanisms are expected to be simple. However, there is no published experimental data for the 0^-, T = 1 state at E_x = 12.80 MeV in this energy region.

We have succeeded to measure the isovector 0^- state in ^{16}O with the Grand Paiden spectrometer after employing the dispersion matching method. Figure 1 shows the excitation energy spectrum of the ^{16}O(p, p') scattering at T_p = 295 MeV and θ_{lab} = 30°. A thin ice (H_2O) -target with a thickness of 10 mg/cm^2 was used. The isovector 0^- state of E_x = 12.80 MeV is clearly separated from the neighboring states with an energy resolution of ΔE = 35 keV in FWHM. Figure 2 compares the preliminary result of the angular distribution for the isovector 0^- state with the DWIA+RPA calculation. The DWIA calculation reproduces the angular distribution fairly well at large momentum transfers of q ≥ 1.5 rm^{-1} .

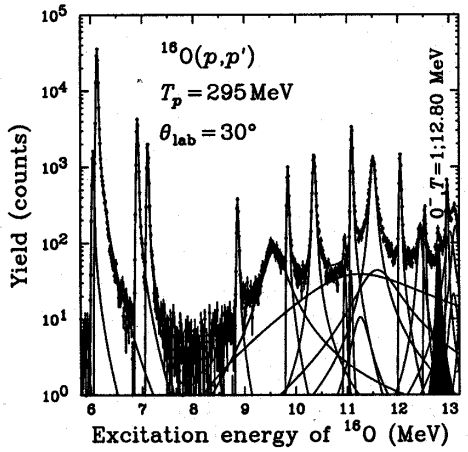

Figure 1: A typical exciation energy spectrum of the ^{16}O (p,p') scattering at T_p = 295 MeV and θ_{lab} = 36°. Results of Hyper-Gaussian peak-fitting are also shown.

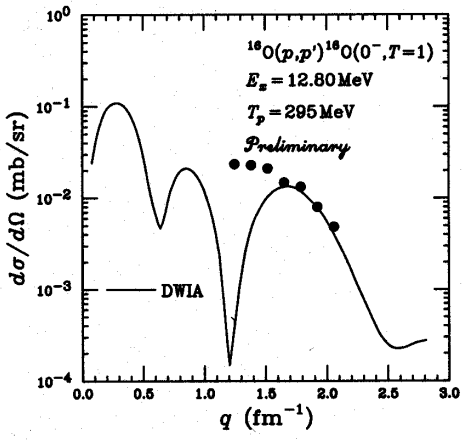

Figure 2: Measured angular distribution for the isovector 0^- state via the ^{16}O (p,p') scattering at T_p = 295 MeV. The solid curve is the DWIA+RPA calculation.